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The Sandakan Herbarium turns a hundred

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Summary. The Sabah Forestry Department's Sandakan Herbarium attained its centenary in 2016. Its history since inception has witnessed challenging episodes, including re-establishment following wartime destruction at the end of the 2nd World War and a fire in 1961, followed by intensive collection rebuilding programmes to support botanical documentation of a spectacularly biodiverse region. The Herbarium moved to Sepilok with the newly established Forest Research Centre there in 1974 and subsequently into its own building by 2000, when the collection had exceeded 200,000. Its expanding role includes supporting forestry programmes and plant science into the future. Modern imperatives for Sabah's conservation and forest management objectives include ecological-floristic assessments and botanical inventories towards Forest Management Plans (FMPs), Conservation Management Plans (CMPs) and High Conservation Value Forests (HCVFs), as well as consolidating conservation habitats and corridors that contribute to the Heart of Borneo programme. Wider afield, plant taxonomic research continues to emphasize the flora of Borneo and the Malesian region, with in-house specializations having included Dipterocarpaceae, Gentianaceae, Pentaphylacaceae, Rubiaceae, Sapotaceae, Poaceae-Bambusoideae and various other tree families.

The Sandakan Herbarium (international acronym SAN; Thiers, continuously updated) was established in 1916. The herbarium's initial functions were modest, set up to support the identification of forest plants, especially timber trees, in tune with the Forestry Department's then limited explorations and operations. The present article recounts how its historical development has transcended the vicissitudes of a century, its long-standing archival functions are now more widely appreciated as relevant to the unfolding importance of natural

resources conservation, and how it moves forward with active application to the aspirations of forestry at home and the wider science of botany in the region.

OPENING SCENARIOS

The Herbarium came into being just 35 years following the initial organization towards a modern state entity. The earlier history of North Borneo is recorded to different detail by various authors but, as Fyfe (1964) put it, "is somewhat confused, being a welter of rivalries between sultanates and pirates, the latter dominating the scene until well into the nineteenth century." By the 1870s and 1880s, trading visitation to the Sandakan Bay area, much focussed on minor forest products and birdnest, had become significant and human settlement became more organized in the township of Elopura founded by William Pryer. Organized governance began with the British North Borneo Chartered Company, which was incorporated in London in 1881 to manage the territory that the British colonial merchant Alfred Dent had acquired from the Austrian Baron Gustav von Overbeck, who held a lease from Brunei for North Borneo. Dent and his associates formed a treaty with the Sultan of Brunei in 1877. Although the Sultan appointed Dent and his associates or successors as 'Maharajah of Sabah' (North Borneo) and 'Rajah of Gaya and Sandakan' with absolute authority ("with power of life and death over the inhabitants...") (Kahin 1947), the Company's appointed head of government was called a Governor. The development of North Borneo was geared towards making profits for its investors and proceeded with an emphasis on planting tobacco, collecting 'jungle produce' such as birds' nests, rattan, gutta-percha and camphor, and cutting timber. In 1888 North Borneo became a protectorate of Great Britain.

Although the British North Borneo Company had to overcome an acute shortage of labour, its request for forestry personnel was turned down by the Colonial Office, who could not make available any of their officers from India, Ceylon or Malaya (Ibbotson 2014). In 1913, Acting Governor of British North Borneo A.C. Pearson issued an encouragement for more Japanese migrants to North Borneo (Yoji 2008). In the same year, the Chairman of the British North Borneo Company Sir Joseph West Ridgeway visited Japan and was recommended the services of an experienced forester and dendrologist Fusaji Goto, who arrived in late 1913 and was employed in British North Borneo from 1914 until 1916 (Shimomoto 2010, Ibbotson 2014). Pearson had also travelled to the Philippines to learn more about forestry administration and training, and thereafter recommended appointment of an American forester (Pearson 1914). Donald M. Matthews from the Philippine Bureau of Forestry was appointed as Chief Forestry Officer in November 1914 and the older Goto, then designated his assistant, was terminated at the end of 1915 at Matthews' recommendation because Goto appeared unable to negotiate effectively with companies and investors. The Forestry Department of North Borneo was thus established in Sandakan by late 1914 (Ibbotson 2014), to manage the commercial exploitation of timber, previously a function of the Land Office that lacked the necessary expertise for forest management (Doolittle 2005).

Matthews appointed three Filipino rangers he knew: José A. Agama, Aniceto Villamil and Mariano Castillo. Together with F.W. Foxworthy, Matthews' associate from Los Baños, he conducted a study of the timber resources in the east coast, resulting in the inaugural issue of the Bulletin No. 1, *Timbers of British North Borneo and Minor Forest Products* (Foxworthy 1916) and No. 2, *British North Borneo Forests: Opportunities for Timber Investment* (Matthews 1916). Matthews appointed another American, D.D. Wood, as Assistant Conservator of Forests and then Acting Conservator in 1916; Wood replaced Matthews as Conservator when the latter resigned in January 1920 to join British Borneo Timbers (Ibbotson 2014).

E.D. Merrill, who began his appointment as a botanist with the Bureau of Science in Manila in 1902 and first visited North Borneo in 1906, instigated the organization of the Sandakan Herbarium. This was begun in 1916, after Matthews initiated his surveys and inventories around Sandakan and the east coast and saw the worth of starting a herbarium. Villamil and Foxworthy started the first North Borneo Forestry Department collection in 1915. Certainly, North Borneo specimens had been gathered at the Manila Herbarium even before then. Merrill, who became highly interested in the Bornean flora, subsequently compiled a bibliographic enumeration of Bornean plants (Merrill 1921).
Ibbotson (2014) wrote—

> "Although Matthews had little time available for botanical work, visits by his friend and colleague from Los Baños, Dr F.W. Foxworthy, assisted by José Agama and [Maximo] Ramos, a trained botanical collector from Manila loaned by [E.D.] Merrill in 1920, had got the herbarium started. This work was continued by D.D. Wood, a keen botanist, who by the time of his retirement had personally collected 2555 specimens. Harry Keith, another keen botanist, continued this botanical work and in 1940 the herbarium at Sandakan contained 10,803 sheets of mounted specimens representing 672 species."

Later, Merrill assumed the Deanship at the College of Agriculture at the Berkeley University, California, where he impressed H.G. Keith, a young Englishman who would later succeed Wood when the latter retired in 1931. Keith was appointed Assistant Conservator of the North Borneo Forestry Department in 1925. Because of Merrill's special interest in Borneo, many duplicate botanical collections were directed to him, through his career at Berkeley and later his directorships at the New York Botanical Garden (from 1929) and the Arnold Arboretum of Harvard University (from 1935).

Keith published *A Preliminary List of North Borneo Plant Names* (Keith 1937, revised 1952) and *The Timbers of North Borneo* (H.G. Keith 1947). Herbarium specimen duplicates were also sent to Kew, where H.K. Airy Shaw gave attention to much of the identification. Keith married Agnes Newton in 1934, who became the celebrated author of *Land Below The Wind* (Keith 1939), an account of their life in North Borneo.

WAR, MISHAP AND FIRE

As the Second World War progressed, Sandakan was occupied in January 1942, just before the fall of British Singapore in February 1942. The harsh conditions of internment of European officers and others after Sandakan was occupied by the Japanese on 18 January 1942 is a story that can never be retold too often. The Keiths were interned and some of their hardship described in A.N. Keith (1947).

Just after the cessation of the War, Kahin (1947) had written—

> "North Borneo is reported to have been one of the most completely devastated of all the areas overrun by the Japanese. Nearly every important town was demolished, largely by Allied bombings... In fact, the material condition of the country is described as having reverted to that at the beginning of chartered rule."

And although Meijer (1968) also recorded, from information available to him, that the Sandakan Herbarium was bombed and destroyed during Australian air raids in [November] 1944, Ibbotson (2014) was inclined to believe that before their retreat, the Japanese had systematically torched sawmills "like the rest of the town and the isolated European houses overlooking it" and summarized—

> "The Forestry herbarium and library were also destroyed in 1945 by the Japanese. The former building contained the collections made by Matthews and Dr Foxworthy, D.D. Wood and Keith himself, all dedicated forest botanists… In all, more than 10,800 sheets were destroyed. To add to this loss to science, the herbarium in Manila, which contained many duplicates of the Borneo specimens, was also destroyed in the war. The saving grace for the taxonomic dendrology of North Borneo's forests was that duplicates of many of the specimen sheets were available in the collections made by E.D. Merrill at Berkeley, C.F. Symington at Singapore and the Royal Botanic Gardens at Kew.
>
> "…when the Australian troops landed in Sandakan on 12 September 1945 they were met with a scene of utter devastation. Not a single building remained standing."

Ibbotson (2014) cites from the memoirs of Assistant Conservator G.S. Brown, who had also been interned during the war and then recalled from his leave in Edinburgh to resume duty in North Borneo, which he did, arriving back in Sandakan in May 1946:

> "Allied air attacks had been responsible for some of the destruction—damage is not a strong enough word—but mostly it was the work of the Japanese. Sandakan was a wooden town and they set it on fire in an insane fury of destruction…The completeness of the destruction was due to the fact that it was done by hand, systematically, using fire."

Meijer (1968) elaborated:

> "Since 1922 it was the American Botanist E.D. Merrill of the Bureau of Science in Manila who worked at the Botanical Exploration of the Philippines… Collections made by Forest Officers in Sabah, mainly Filipino Forest Rangers like Castro, Melegrito, Apostol, Orolfo and Agama were sent to Merrill for determination. Extensive collections were made by the American plant collector…Elmer for the Bureau of Science in Manila during 1921–

1923 near Sandakan and Tawau. Merrill published a special paper about these collections in the University of California, Publ. Bot. 15: 1–316 (1929)."

Following the implementation of British Military Administration, subsequently the British Borneo Civil Administration Unit (BBCAU), José Agama and other forestry staff who had stayed on in North Borneo reported for duty in December 1945. Agama, then Assistant Conservator, was tasked to restore the Forestry Department (Ibbotson 2014). When North Borneo became a British colony on 15 July 1946, Chartered Company administration ended, but Keith and Brown were respectively appointed Conservator and Assistant Conservator of Forests. The Sandakan Herbarium resumed, abandoning the older British North Borneo (B.N.B.) and Sandakan Herbarium (S.H.) collecting number series and beginning the post-war A series (Keith 1952). The B.N.B. and S.H. numbers are in fact in the same series, and there is a bit of confusion because labels inscribed "B.N.B. Forestry Department" were printed at Kew and applied partly to pre-1945 collections but also partly to post-1945 "A" and "SAN" numbers. The A series ranged 1–5000.

Apparently Keith and Brown were not satisfied with responses from the colonial administration regarding the post-War development of forestry resources and the timber industry and left North Borneo in 1952 and 1954, respectively, the former on retirement and the latter on transfer to the Malayan Forest Service (Ibbotson 2014). The background as regards timber was essentially the same: within just five years following the War, Australia, the United Kingdom, South Africa, Hong Kong/ Shanghai and even Japan were increasing their imports of North Borneo logs once again. The demand for timber seemed insatiable. Notwithstanding, Ibbotson (2014) points out that post-war concessions were based on a 100-year rotation, with still a 70% forest cover in Sabah in 1963, of which some 2.59 million ha was lowland dipterocarp forest (i.e., lowland forest dominated by the tree-family Dipterocarpaceae). Nevertheless, timber production in Sabah rose from nearly 100,000 m^3 in 1947 to around 5 million m^3 for the period 1947–1959, some 10 million m^3 in 1974, and 13 million m^3 in 1978 (Reynolds et al. 2011). After 1959, the value of timber exports exceeded that of rubber, and the timber industry "has made Sandakan one of the great timber ports of the world" (Lee 1965). North Borneo became Sabah in 1965, when the British withdrew and Sabah joined the Federation of Malaysia, with sweeping socio-political transformations to follow.

The Forest Department's Herbarium had difficulty treading a more stable path in the immediate two decades following the War. In 1947, the Sandakan Herbarium was allocated a building which had housed the Public Works Department, allowing the collection programme to resume. By 1952, when A.B. Walton succeeded Keith as Conservator, the need for a Forest Botanist and proper botanical research was acutely felt. That year the collection amounted to 7400 sheets. Dipterocarp inventory and collection continued to dominate botanical work, as that group of trees were among those that formed the backbone of the timber industry. Walton sought the advice of Wyatt-Smith, the botanist at Kepong. The following year, the

Sandakan Herbarium moved to a building known as the Bird's House Godown and was about to engage its first dedicated forest botanist. Meijer (1968) recorded—

> "A very suitable candidate was found in Geoffrey Wood, who arrived in Sabah on the 8th March 1954. He started an energetic collecting drive throughout the State in 1954... accompanied by the Forest Botanist from Malaya, Mr. J. Wyatt-Smith on a trip on the West Coast including an ascent on Mt. Kinabalu. The great year for Geoffrey Wood was 1955 when trees flowered and fruited all over the State. He collected more than 1625 specimens of which 481 belonged to the Dipterocarps. During 1956 he worked on the distribution of these specimens and on the manuscript of a Record of Common Dipterocarps. He went that year on leave and returned to Sabah. His first new trip was in Brunei with B.E. Smythies, and P.S. Ashton then Botanist in Brunei."

It was during that trip to Brunei in May 1957 when Wood died of burns from an accident at camp. Smythies (1960) wrote: "As a party they [Wood and his Dusun expert tree climbers Kanis and Kalukut] were perhaps the most efficient collecting unit the forests of Borneo had seen up till then. Not since the days of Beccari, nearly a century ago, had any botanist collected the trees month after month over a period of years, as Geoffrey did." Just a year before, a checklist of the forest flora of North Borneo by Wood and Agama (1956) was published. It was also Wood who started the SAN series (beginning with SAN 15000 to avoid any possible overlap with past series) in 1954 that has continued until today. Willem Meijer, primarily a bryologist who had earlier worked on general identifications based at the Bogor Botanical Garden and taught botany at the Universitas Andalas in Central Sumatra, and who was forced to leave as civil war broke out in Sumatra, succeeded Wood as Forest Botanist in North Borneo, serving from May 1959 until 1968 (Wong 2004). Meijer continued and completed a detailed botanical documentation of dipterocarps begun by Wood (Meijer & Wood 1964).

Another disaster was soon to strike. Meijer (1968) wrote:

> "...this country was botanically far less explored than, for example, Malaya. Up to 1950... the total number of specimens collected per 100 sq.km. [was in]...Sabah 35, and on [the] Malay Peninsula 110... Not more than 10 percent of the...State was...known botanically... It was also clear that it would not be possible to continue work in Sandakan if the Herbarium would have to remain in the old wooden building of the bird nested godown, where on [a] floor space of 10 x 10 m, 15,000 postwar collections, places for [the] Ecologist with 2 Assistants, Botanist with 2 Assistants, typists, map cabinets, files, card indexes, wood samples and recently mounted specimens would have to remain cramped together. All our efforts to get a new building were fruitless..."

On the night of 31 January 1961, fire spread from an adjacent veneer factory belonging to the British Borneo Timber Co. and razed the Herbarium to the ground (Fig. 1). Meijer recorded that "everything except the manuscripts of the Forest Records, the photographs taken by the Forest Botanist and the unmounted 1959–1960 collections went up in smoke and ashes." Some 15,000 herbarium specimens and several hundred wood specimens were lost in that fire (Fig. 2).

Fig. 1 (above). The night of the fire, 31 January 1961, when flames spread from an adjacent veneer factory and razed the wooden building housing the Sandakan Herbarium to the ground. (Forest Research Centre archives)

Fig. 2 (right). Scorched remains: a specimen of *Timonius flavescens* Baker (Rubiaceae) by Meijer, collected in 1959 before the disastrous fire. (Forest Research Centre archives)

In retrospect, Meijer observed—

> "After the fire I was asked by a Government Official [what was] the value of these collections and why we collect plants for the Forest Department. It seems not superfluous to repeat the answer here. Botanical collections are the records on which our studies of the Flora of this country are based. A rational use of the plants including timber trees, medicinal plants and weeds is not possible without describing, naming and classifying these

plants. This is basic research. Studies of forest regeneration are impossible without the use of floras with which the plants in the forest can be named. Doubtful namings have always to be checked by reference to the well arranged collections which are kept as far as possible up-to-date by inserting the results of our own research on Dipterocarps and the results of other botanists who are studying other families. When we want to educate local people in Forestry and Agriculture, we need an Herbarium and books on the Flora of Sabah."

THE MODERN-DAY SANDAKAN HERBARIUM

Meijer's energy after this catastrophic destruction of the scientific archive of Sabah displayed an astonishing determination put into practice. Collectors, including staff augmented from the Forest District Offices, were stationed in various parts of Sabah, collecting all year round and sending material back to the Sandakan Herbarium (Fig. 3). Between 1962 and 1964, the furious pace of collecting brought in over 10,000 specimens each year. W.J. Pereira, Aban Gibot and Leopold Madani were Meijer's principal sources of assistance. In 1964, Meijer reported a total holdings of 17,200 accessions for the Sandakan Herbarium. In the same year, the new Herbarium was ready near the Ching Meng School, the first permanent home of the Forest Department Research Branch in Sabah (Fig. 4). Abdul Rahim, James Ah Wing, J. Ampuria, David Brand, Muin Chai, David Charington, George Mikil, Jaswir Singh, Masirom Rundi and Henry

Fig. 3. *Borneodendron aenigmaticum* Airy Shaw, found only on soils derived from ultramafic rocks in Sabah, was described based on the type specimen gathered just several months following the January 1961 fire that destroyed the Sandakan Herbarium. (Photo: M. Sugumaran)

Fig. 4. The Sandakan Herbarium was housed in a building on the Ching Meng School premises in 1964. (Forest Research Centre archives)

Sinanggul were among the main contributors of specimens at that time. In 1965, Andries Kanis, a Dutch botanist, was deployed to the Sandakan Herbarium by the Dutch Ministry of Foreign Affairs, and was acting head of the Herbarium for about nine months; he returned to Leiden in 1966. By 1968, the collection had 27,575 specimens. By Meijer's reckoning, "The general policy of the Sandakan Herbarium is to work steadily on a botanical survey of Sabah. It is not a stuffy museum for specimens of plants which we are going to rescue for Herbarium workers while we let them disappear in the jungle but the active centre of botanical field research" (Meijer 1964). Meijer was not an exception in appreciating Mount Kinabalu as a special site of biological richness (Meijer 1965, 1971) and collected very many specimens from that truly special mountain, these forming a special archive at the Sandakan Herbarium today. Thus the re-establishment of the modern-day Sandakan Herbarium was very much launched by Willem Meijer.

Meijer championed many things on the Sabah landscape (Wong 2004). Aside from making his full support known for conserving Kinabalu, he had special remarks about Sepilok and Kebun China on the Sandakan Peninsula. In a 1966 departmental memo, he wrote, "…Sepilok Forest Reserve is so far the only area larger than 2000 acres of virgin lowland Dipterocarp

forest set aside for [the] purpose of research, education and wildlife protection…". He also began to build up a flora of the Kebun China forest, just several kilometers from Sandakan town, which was not a forest reserve but was the only near-pristine site on the Sandakan peninsula aside from Sepilok and some mangrove patches there.

Following the departure of Meijer, P.F. Cockburn was appointed Forest Botanist in 1969; he wrote up a number of families for the *Trees of Sabah* (Cockburn 1976, 1980) and left in 1977. Gary Shea, a Canadian University Service Overseas Volunteer, was attached to the Sandakan Herbarium in 1971–72.

In 1974, the Herbarium moved into the newly opened Forest Research Centre in Sepilok and by 1976 the collection had amounted to 53,024 sheets. In 1977, K.K. Tiong was appointed Forest Botanist but left in 1979, when Aban Gibot took charge of the Herbarium. Then Lee Ying Fah was appointed Forest Botanist in 1983, followed by Jumrafiah Abdul Shukor in 1987. Julius Kulip was put in charge of forest botany in 1989. Then Lee sought the appointment of K.M. Wong, who had been in Brunei as Forest Botanist since 1987, and before that in the Forest Research Institute Malaysia (FRIM), to head the Sandakan herbarium in 1992. Wong helped to spearhead the first two volumes of the newly organized *Tree Flora of Sabah and Sarawak* with FRIM, and was liaison officer for the project at the Royal Botanic Gardens, Kew, for a few months in 1994, before leaving at the end of 1996 for the University of Malaya in Kuala Lumpur. His own specializations were in the Rubiaceae, bamboos and Gentianaceae. Berhaman Ahmad was recruited as Forest Botanist in June 1992, working on the Alangiaceae and Bignoniaceae, but left in November 1997 to join the Universiti Malaysia Sabah. John B. Sugau, joined in 1993 and worked on Pittosporaceae, Chloranthaceae, Gentianaceae, and Pentaphylacaceae/Theaceae for the Tree Flora project. After Wong left, Lee Ying Fah headed the Sandakan Herbarium until 2002. Sugau was in charge of the Sandakan Herbarium since Lee became the Head of the Forest Research Centre in 2002 and until the present time, assisted by Joan T. Pereira, the latter recruited in 1994 and then revising the Staphyleaceae, Crypteroniaceae and *Payena* (Sapotaceae). Pereira completed her doctoral studies under Wong and A.L. Lim in 2009 on the *Rothmannia* complex (Rubiaceae). Suzana Sabran joined the Sandakan Herbarium in 2003 and specialized in *Ternstroemia* (Pentaphylacaceae) and *Sarcosperma* (Sapotaceae). Later in 2012, Andi Maryani binti Mustapeng joined the Herbarium, working on bryophytes, lycophytes and ferns. Lee, Wong and Robert C. Ong founded Sandakania as the Forest Research Centre's botanical journal in 1992. This has a plant systematics and natural history focus, compared with the Sepilok Bulletin, begun in 2004 by Lee and V.K. Chey, which includes both plant and animal, as well as ecological articles of contemporary interest in Sabah.

CENTURY XXI

The present Sandakan Herbarium building was ready in 1999 (Fig. 5), built with funding from the Federal Government under the 7th Malaysia Plan. It provided a bigger area for

Fig. 5. The Sandakan Herbarium in its own building, 2016. (Photo: Ubaldus Majawal)

storing specimens in steel compactors with an annexe for drying, as well as pressing and poisoning specimens. The move into the new building was completed in 2000, and this latest premise became the new botanical nerve centre, although the building itself was officiated in 2003.

Today, the Sandakan Herbarium holds a total of some 200,800 accessions (including 272,000 specimen sheets). In 2015, moving in tandem with modern classification, the SAN Herbarium began adopting the Angiosperm Phylogeny Group (APG) classification. Specimens were digitized and stored in the Botanical Research and Herbarium Management System (BRAHMS), which was developed by Oxford University, allowing easy access of specimen data and the collation of plant checklists and production of specimen labels. SAN also curates ancillary spirit-preserved collections amounting to 4359 numbers, and keeps 1852 carpological collections. Since 2004, the processing and curation of herbarium specimens at SAN was placed under MS ISO 9001:2008 certification.

Following the timber boom, the premature re-logging allowed in the 1970s and 1980s, and onslaught of conversion to oil palm cultivation (Fig. 6) in the early 1980s brought huge changes in land use, and by 1990 just 500,000 ha of primary lowland forest remained (Marsh & Greer 1992). Sabah now addresses a course that follows up on the 1983 decision to maintain half of its total land area as a permanent forest estate and by 2011 the gazetted

Fig. 6. A vastly changed Sabah landscape in the 1990s, when large-scale oil palm plantation agriculture began to take up most of the accessible lowlands, intensifying pressure on forested land. (Photo: K.M. Wong)

area of Forest Reserves and State Parks was some 53% of land area (Ibbotson 2014). Sabah has experienced an approximate 35% reduction in natural forest cover in the past 60 years (McMorrow & Talip 2001, Reynolds et al. 2011), with the loss further exacerbated by much degradation and fragmentation of some remaining forest areas (Mannan & Awang 1997, Bryan et al. 2013). The Forestry Department has felt the urgent need to conserve the remaining forests and ensure more sustainable timber-related programmes. Presently, the State Government through the Forestry Department has set aside 21% or 1.5 million ha of Sabah's land area as Totally Protected Areas (TPAs), including forest reserves within the categories Class 1 (Protection Forest Reserve), Class 6 (Virgin Jungle Reserve) and Class 7 (Wildlife Reserve) (Anonymous 2014). The 3-fold increase of TPAs in Sabah within the last ten years has resulted from this renewed commitment to habitat conservation for biodiversity and other environment-related values.

The Botany Section was at the core of conceiving and establishing two of Sabah's major facilities that engaged public awareness for forests and the environment, both located in the Sandakan area. Both efforts garnered the participation of colleagues in the Conservation, Ecology, Entomology and Silviculture sections at the Forest Research Centre. The Rainforest Interpretation Centre and Rain Forest Walk (*Rintis Belantara*) were established at the Arboretum in Sepilok, Sandakan, in May 1994, with funding support through the

Deutsche Gesellschaft Fuer Technische Zusammenarbeit (GTZ), Germany. After 2007, this was transformed into the present-day Rainforest Discovery Centre (Fig. 7), which has become a model facility for tropical forest conservation and environmental education. The continuing development of this Centre (Fig. 8) is led by the energetic Silviculturist Robert C. Ong. Nearer to Sandakan town, the Kebun China forest which had received the emphasis of Meijer, followed by Lee, and then the special interest of the Director of Forestry Datuk Sam Mannan, became gazetted in 2007 as a Forest Reserve; at the edge of the Reserve was developed the 148-ha Sandakan Rainforest Park jointly managed with the Sandakan Municipal Council (Damit 2013). This reserve is the type locality of more than a hundred species of plants described over the course of the Sandakan Herbarium's century.

The Herbarium is actively involved in spearheading newer initiatives including the internationally sanctioned Heart of Borneo (HoB) initiative (Fig. 9), RAMSAR site studies, IUCN Red-Listing of plants, as well as collaborating in research studies with both local and overseas research institutes. With this strengthened emphasis in the Forestry Department, the Herbarium has intensified its involvement in botanical inventories supporting Forest Management Plans (FMPs), Conservation Management Plans (CMPs), and the identification

Fig. 7. The Rainforest Discovery Centre at the Forest Research Centre's Sepilok Arboretum. (Photo: K.M. Wong)

Fig. 8. Part of an impressive canopy walkway system, Sepilok Arboretum. (Photo: K.M. Wong)

Fig. 9. Participants in the 2014 Northern Gunung Rara Scientific Expedition, part of Sabah's Heart of Borneo programme, pressing their plant specimens. (Photo: Ubaldus Majawal)

and characterization of High Conservation Value Forests (HCVFs). As the world generally now discovers, degradation of landscapes and natural resources are least profitable and most impactful when not informed by, or heeding, the insights from careful inventories of life forms and the natural biota. The reduction of ecological and biological diversity exacts a vengeance that impoverishes human societies.

Effective support for these programmes and ideals simply means that both science and practical involvement need to be pursued hand-in-hand. Floristic documentation under the *Tree Flora of Sabah and Sarawak* project and the more recent *Flora of Peninsular Malaysia* continues to engage botanists based at SAN. Under the 9th and 10th Malaysia Plans, SAN botanists have also increased cross-discipline collaborations with other sections in the Forest Research Centre that look into promoting the medicinal documentation and ornamental use of indigenous plants. With the build-up of reference materials over the years and better-equipped facilities available at the Herbarium, the provision of tree identification courses to students at the Sabah Forestry Institute, local universities, Sustainable Forest Management Licencee Agreement holders (SFMLA), and other governmental or non-governmental agencies, is now better served. These courses help develop expertise in tree identification

and create a stronger awareness and interest in plants among students who eventually hold a stake in the forestry endeavour. The Forestry Department targets to have as many forest areas as possible certified under the internationally recognized forest certification scheme with the Forest Stewardship Council (FSC), so that staff in Forest Management Units (FMUs) skilled in various basic areas including plant identification becomes a prerequisite. Botanical staff members are also engaged in providing talks or poster presentations on the state's natural heritage in local and international seminars, conferences, and workshops, adding stimulus to the promotion of ecotourism and environmental education.

INTO THE FUTURE

Over its century, the Sandakan Herbarium has emerged as one of the largest herbaria in Malaysia, and one of the most important collections and reference centres for the Bornean flora. Yet, it plays a key role in coupling to forestry and conservation management efforts on the ground. In spite of the Herbarium being an important asset to the Department and the state of Sabah, it has its own challenges. With an estimated 7400 species of seed plants in Sabah (Maycock et al. 2015), it is impossible to study each of the species, let alone to complete a Flora account of Sabah in a short span of time. The Forest Research Centre currently has but four trained plant taxonomists, and their specializations are both important to maintain and balance with other functions.

As the Forestry Department's purview over forest resources increases in scope and intensity, and the need for botanical specialization to better cover a highly diverse floristic region becomes more obvious, the imperative for more taxonomists and other botanical staff to join the effort is more greatly felt than ever before. Aspirations to fully digitize its herbarium collection and develop a geo-mapping system for the geographic location of specimens via BRAHMS will help make it possible to provide fundamental plant and vegetation data, such as distribution patterns and endemicity, conservation status and the ability to assess the potential impacts of environmental and landscape changes on species. There is no doubt that support from within and without, both in terms of staffing expertise and funding needs, will be increasingly important determinants of success. The Sandakan Herbarium moves into its second century more accomplished and focussed than ever before, and with a fundamental mission firmly entrenched in the environmental, economic and social well-being of Sabah.

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> "It is clear to all taxonomists and all systematic botanists, that in spite of the imperfections in our current system of naming and describing plant species, and in spite of the distinctly Rafinesquian character of the work of certain individual botanists who can see differences where tangible differences scarcely exist, that taxonomy and the accurate identification of plants is basic to a proper understanding of myriads of

problems in the general field of economic botany, pharmacology, agriculture, plant breeding, plant pathology, genetics, forestry, morphology, physiology, and many other fields into which plant science or botany, *sensu latiore* has been subdivided.

"Let us take the broader view, live and let live, keep our respective houses in order, avoid egregious blunders, and attain a realization of the fact that after all there is a unity in plant science in spite of its diversity, and that the entire field is interlaced with the binding bonds of system and order; and this is taxonomy."

E.D. Merrill (1943)

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Appendix: Forest Botanists in charge (or Curators) of the Sandakan Herbarium.

Year	***Forest botany purview*** **or Forest Botanist in charge**
1916–1920	(*under Forest Conservator Donald M. Matthews*)
1920–1931	(*under Forest Conservator Devillo D. Wood*)
1931–1952	(*under Forest Conservator Henry G. Keith*)
1952–1954	(*under Forest Conservator A.B. Walton*)
1954–1957	Geoffrey Howorth Spencer Wood
1959–1968	Dr Willem Meijer
1969–1977	Peter Francis Cockburn
March 1977–December 1977	(*under Asst Forest Conservator Wilfred James Peter Pereira*)
1977–1979	Stephen K.K. Tiong
1980–1983	Aban Gibot
1983–1987	Lee Ying Fah
1987–1989	Jumrafiah Abdul Shukor
1989–1992	Julius Kulip
1992–1995	Dr Wong Khoon Meng
1995–2002	Dr Lee Ying Fah
2002–present	John Baptist Sugau